



## **A study of thermoelectric -Zn<sub>4</sub>Sb<sub>3</sub> under thermal cycling and large temperature gradients**

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## **BOOK OF ABSTRACT**

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## PA188

### A study of thermoelectric $\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> under thermal cycling and large temperature gradients

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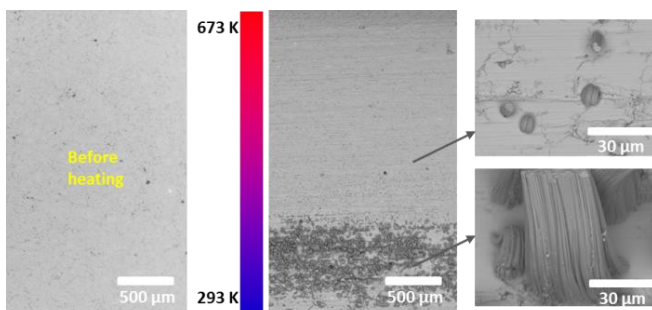
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$\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> is among the highest performance and lowest cost thermoelectric (TE) materials in the medium to high temperature region [1]. However, the usage of this material in practice for TE power generation is still hindered. In this study, the thermoelectric properties of  $\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> legs are investigated under thermal cycling at hot-side temperatures up to 718 K, and in a large temperature difference of 653 K, corresponding to the hot and cold side temperatures of 673 K/293 K. The results after thermal cycling reveal that a  $zT$  value of about 1.4 at 718 K is maintained after 30 cycles. However, under a temperature gradient of 653 K for 24 hours, the  $\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> leg gradually decomposes into zinc whiskers and ZnSb. This occurs in a temperature range lower than 563 K due to the nature of the phase transition [2]. This study provides insight into the stability of  $\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> under large temperature gradients.



**Figure 86:** SEM micrographs of  $\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> sample before and after 24 hours under temperature gradient of 653 K.

#### References:

- [1] Y. Sun et al., "Low-Cost High-Performance Zinc Antimonide Thin Films for Thermoelectric Applications", *Adv. Mater.*, vol. 24, 1693 (2012).
- [2] J. Lin et al., "Unexpected high-temperature stability of  $\beta$ -Zn<sub>4</sub>Sb<sub>3</sub> opens the door to enhanced thermoelectric performance" *J. Am. Chem. Soc.*, vol. 136, 1497(2014).